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Simulation-based ENT induction: validation of a novel mannequin training model

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Abstract

Objective. To ascertain whether simulation-based teaching is superior to lecture-based teaching for an induction programme using a home-made induction model.

Methods. A simulation-based induction programme was designed and separate lecture-based teaching covering the same content was organised for junior doctors. The junior doctors were asked to complete pre- and post-induction surveys regarding confidence and anxiety levels. The skills taught included microsuction, flexible nasendoscopy, and anterior and posterior nasal packing. Structured interviews were conducted after the programme to gain qualitative data for analysis. The trainees' knowledge retention was compared using a standardised written assessment one month after the session.

Results. Simulation-based teaching using the induction model was associated with a statistically significant increase in confidence levels and reduction in anxiety levels, and was associated with greater knowledge retention.

Conclusion. A regular simulation induction programme should be introduced using the induction model, as it leads to better knowledge retention and increased confidence levels.

Main Article

Miss S Bhalla takes responsibility for the integrity of the content of the paper

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Introduction

The benefits of simulation training have been well documented in medical education, and in other industries such as aviation and military services. Training has been affected in recent years because of continuing changes in the healthcare system.[1–3] Barriers to learning include infrequent training opportunities and increased demand for consultant-delivered practice.

The learning and practising of skills by novices on any patient raises patient safety concerns.[4] Many other specialties have already integrated simulation-based education opportunities into their curriculum[4] and simulation-based education is now considered an integral component of surgical training.[5]

Currently, it is felt that there is a poor representation of ENT in the medical school curriculum. A recent study of 26 medical schools showed that there were compulsory ENT placements and rotations for just 53 per cent of students, and 10 of the 26 medical schools included in the study did not offer an ENT attachment at all.[6] The average duration of an ENT attachment in medical schools varies from 7.5 to 13.4 days.[6,7] The short length of ENT attachments, or indeed the absence of them, is clearly inadequate, especially as more than 1 in 10 presentations to general practice involve ENT pathology.[8] A review of the undergraduate curricula revealed that most final year students do not feel adequately prepared to practise ENT because of the limited duration of clinical rotations and the lack of opportunity for practical learning.[9]

As a trainee, night-time ENT cover is often provided by a junior doctor with little experience in ENT. One study showed that 68 per cent of these doctors (across 91 hospitals in the UK) had no prior ENT experience, with 42 per cent not being comfortable in managing acute ENT conditions.[10]

To our knowledge, there is no consistent induction programme or induction model currently in use that is aimed at those with little or no ENT experience, and which is designed to allow the practising of practical skills required to deliver acute ENT services. Therefore, a simulation-based induction programme was introduced using a home-made simulation model. The induction programme itself was assessed using a qualitative analysis and the induction model was evaluated via quantitative analysis.

Materials and methods

Quantitative data

We conducted ENT-specific induction programmes with a focus on practical skills using a home-made simulation model (Figures 1 and 2), in the UK and in Australia. The induction involved training on anterior and posterior nasal packing, cautery, microsuction, foreign body removal from ears and nose, and flexible nasendoscopy (Figures 3–5).

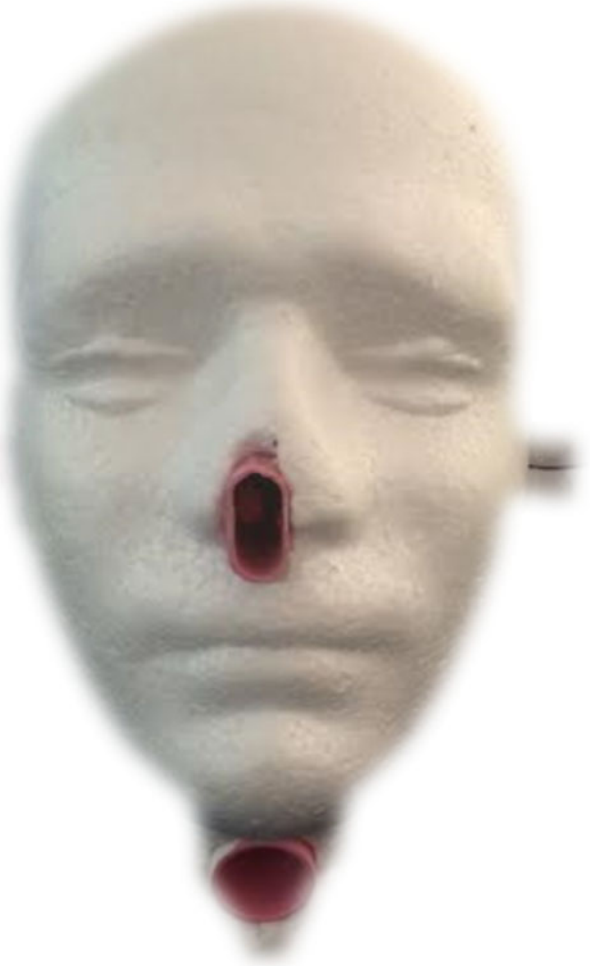

Fig. 1. Anterior view of home-made induction model.

Fig. 2. Lateral view of home-made induction model.

Altogether, 38 candidates used the model during their induction programmes. There were 14 candidates in the UK induction, with 3 being international students, and 24 candidates in the Australian induction. Therefore, 27 international candidates and 11 national candidates were involved in the quantitative analysis. Of the 14 candidates who participated in the UK induction course, 9 were foundation year 2, 3 were foundation year 1, and 2 had completed their foundation years.

Fig. 3. Induction model being used for microsuction.

Fig. 4. Induction model being used for flexible nasendoscopy.

In addition, we ran a lecture-based induction course in the UK for junior doctors. The course included the same content as the simulation-based induction course, but with more of a focus on knowledge-based teaching of practical skills. Thirteen candidates took part in this induction, and all were foundation year 2 doctors.

Candidates were asked to complete anonymous pre- and post-induction surveys regarding anxiety and confidence levels for each of the skills, using a 10-point Likert scale, for both the simulation-based induction and lecture-based induction course.

We asked candidates to complete a written assessment one month after both the simulation-based and lecture-based induction programmes to assess knowledge retention following the course. This involved a multiple choice questionnaire of 20 questions. Candidates were asked to complete the questionnaire

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Fig. 5. Induction model being used for nasal packing.

in person before collecting their certificates; therefore, use of the internet or additional books was not allowed.

Qualitative data

In order to gain qualitative data, rather than analysing the model itself, we considered the induction programme as a whole. A combination of both convenience and purposeful sampling was utilised to allow trainees with more considered views to identify themselves, therefore providing more valid responses. We aimed to interview 8–10 trainees out of the 11 delegates who participated in the induction session in the UK. Six trainees responded and were interviewed, each of whom had a different grade, with a different motivation for attending the simulation course. All respondents had a different amount of exposure to ENT, whether this was in medical school or working within the specialty. Following initial thematic analysis, further interviews would be conducted if saturation of themes had not occurred.

Structured interviews were chosen as questions can be developed as they arise. Focus groups can risk delegates copying answers from one another and being influenced by others' views. Furthermore, given the time constraints, it would be difficult to gather enough junior doctors together at the same time. Questionnaires were considered; however, responses may be minimal, and development of further questions is limited. There is also a risk of gaining minimal data for thematic analysis, resulting in a different method of data collection, which is time-consuming.

Example questions for the structured interview are shown in Appendix 1. The interviews were recorded on a voice-recording mobile phone application. Data were stored on an encrypted memory stick and were transcribed. A non-response to the initial e-mail invite was followed up by repeat emails or announcements at their regular teaching sessions as reminders.

The study did not collate any numerical data other than simple participant demographics. Transcribed data from structured interview recordings underwent emergent coding and thematic analysis.

No patients were involved in this study and therefore patient consent was not required. No personal data, patient information or professional information were taken from participants; therefore, ethical approval was also not formally sought for this project, but departmental approval was granted for the project to be undertaken.

Results

Quantitative data analysis

Simulation-based induction

The average confidence level before the induction for all the candidates for the skills taught was 4.09 in the UK induction and 2.2 in the Australian induction. The average anxiety level

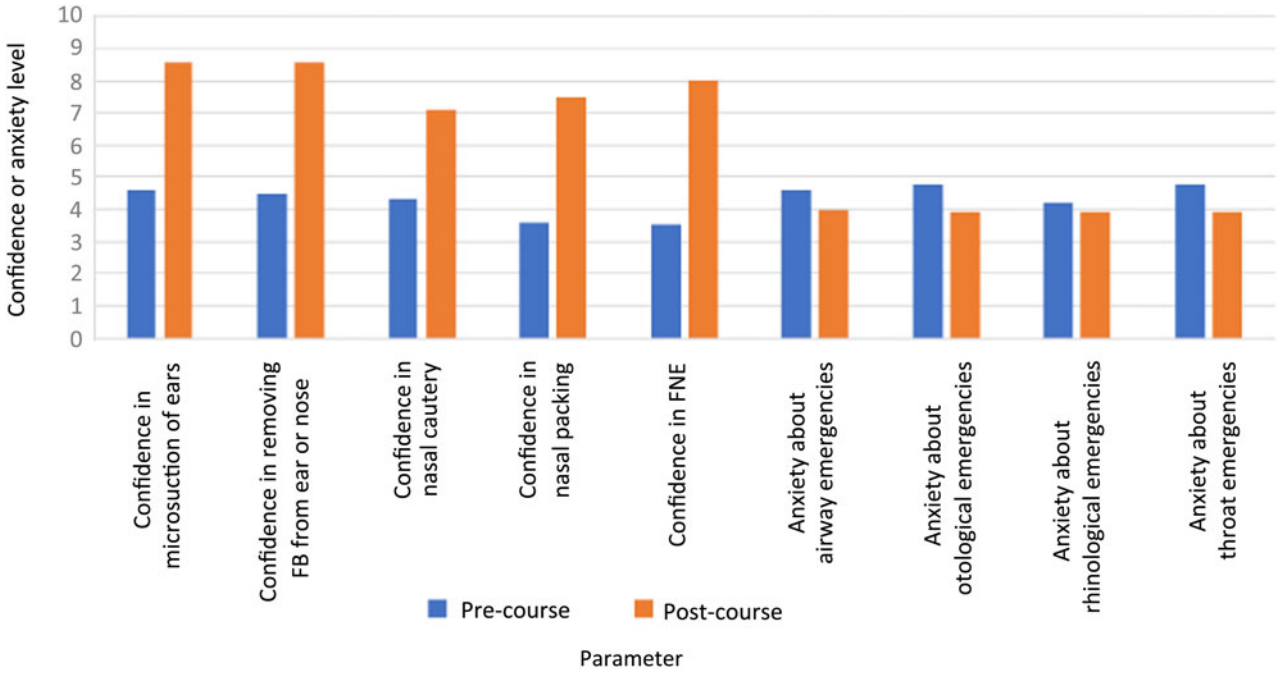

Fig. 6. Confidence and anxiety levels before and after induction using simulation models. FB = foreign body; FNE = flexible nasal endoscopy

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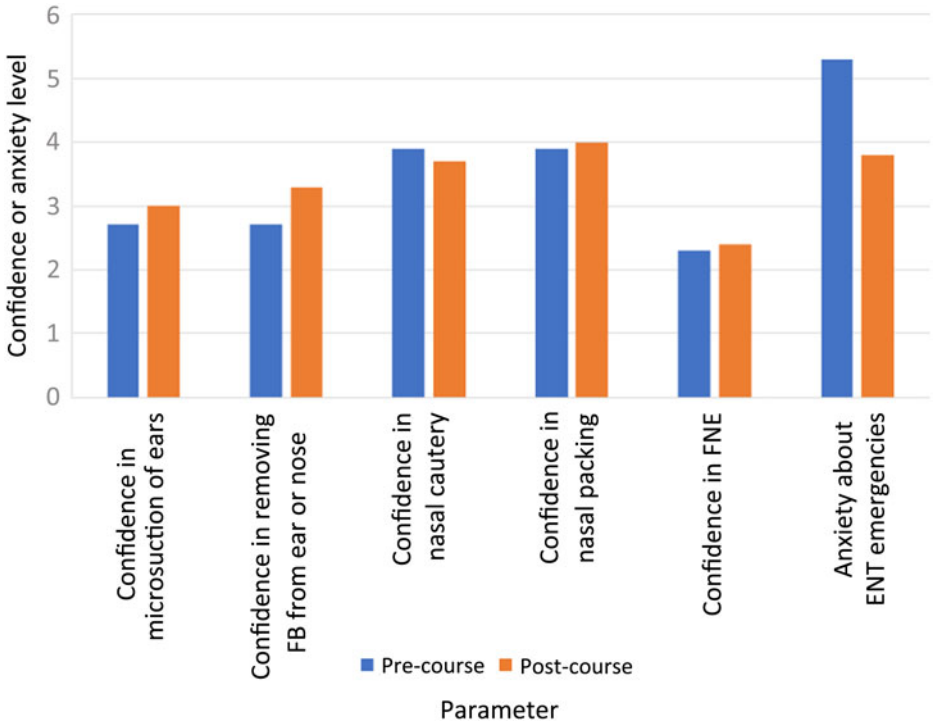

Fig. 7. Confidence and anxiety levels before and after induction using lecture-based teaching. FB = foreign body; FNE = flexible nasal endoscopy

regarding airway, otological, rhinological and throat emergencies before the induction were 4.5 in the UK induction.

After the induction, the average confidence levels for all the candidates for the skills taught increased to 7.6 for the UK induction and 7.65 for the Australian induction. The average anxiety level regarding airway, otological, rhinological and throat emergencies after the induction decreased to 3.9 in the UK induction.

The Wilcoxon matched pairs signed rank test was used for statistical analysis. This showed a statistically significant increase in confidence levels and a statistically significant decrease in anxiety levels (Figure 6).

Lecture-based induction

The average confidence level before the induction for all the candidates for the skills taught was 3.46 in the UK and the Australian induction programmes. The average anxiety level regarding airway, otological, rhinological and throat emergencies before the induction was 5.28.

After the induction, the average confidence level for all the candidates for the skills actually decreased to 3.2. The average anxiety level regarding airway, otological, rhinological and throat emergencies after the induction decreased to 3.8 in the UK induction.

The Wilcoxon matched pairs signed rank test was used for statistical analysis. This showed no significant difference in confidence and anxiety levels before and after the lecture-based induction for the skills taught (Figure 7).

The written assessment that candidates were asked to complete one month after the course showed an average score of 17 out of 20 after simulation-based teaching ($n = 15$), and 12.3 out of 20 after lecture-based teaching ($n = 13$).

Qualitative data analysis

Following an initial e-mail, six trainees agreed to participate in the structured interview after the simulation session. Each trainee had a different amount of exposure to ENT and took part in the simulation session for different reasons (Table 1).

Table 1. Participant demographics

Participant number	Weeks of teaching in ENT	Reason for participating in simulation session	Stage of training
1	0	Interest in ENT	Foundation year 2
2	0	Providing acute ENT services	A&E specialty trainee year 2
3	4	Providing acute ENT services	Core surgical trainee year 1
4	1	Interest in ENT	Core surgical trainee year 2
5	2	Providing acute ENT services	A&E foundation year 2
6	0	Providing acute ENT services	GP specialty trainee year 2

A&E = accident and emergency; GP = general practitioner

Interviews were conducted using the interview template shown in Appendix 1, which did not need to be modified.

Following emergent coding and thematic analysis, thematic saturation was reached, so no further interviews were required.

A total of 24 independent codes were identified, which led to the development of 7 themes: (1) views of simulation; (2) utility of teaching; (3) other experiences of simulation; (4) comparison to other methods of teaching; (5) change in behaviour after teaching; (6) suggestions for improvement; and (7) contribution to career planning.

Full details of coding, thematic analysis and supporting interviewee quotes are given in Table 2. Themes are explored below.

Discussion

Our results show a significant increase in confidence levels and a reduction in anxiety levels after simulation-based teaching using the induction model, as compared to lecture-based

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Table 2. Emergent coding and thematic analysis breakdown

Themes	Codes	Quotes from interviewees
Views of simulation	Simulation advantages	'Practising on model is best way before practising on patients', 'good to practise in safe environment', 'simulation is a good idea'
	Simulation disadvantages	'Daunting if you don't know the procedures at all', 'expensive & often have to pay for courses', 'not useful if you want to cover lots of knowledge', 'not same as doing on a patient', 'feels not genuine & fake', 'models may not be available to many centres that offer ENT', 'models are unrealistic'
	Practical benefits	'Good for hands-on experience', 'useful for practical experience', 'practising away from patients is useful'
Utility of teaching	Perspective on teaching content	'Useful to meet curriculum needs for ENT', 'great for a specialty like ENT'
	Meeting trainees' educational needs	'Useful to meet curriculum needs for ENT', 'useful as minimal teaching of ENT in medical school'
	Utility specifically to ENT	'Good as ENT is practical specialty & often on call, when you do procedures for first time they are on patients', 'enhances learning for ENT', 'useful for those providing acute ENT services', 'useful as ENT is practical'
	Additional teaching beyond programme	'Would be useful to do lecture-based teaching also', 'should be made regular & not at expense of other on-the-job learning'
Other experiences of simulation	Using simulated models	'On general medicine for insertion of drains on models'
	During medical school	'Simulated scenarios for emergencies', 'scenarios when practising communication skills'
	Other simulated settings	'Experience of simulated ward rounds but not procedures', 'simulated ward rounds', 'simulation with patients in F1 [foundation year 1] teaching'
	During other courses	'simulated scenarios on ALS [advanced life support]'
Comparison to other methods of teaching	Comparison to lecture-based teaching	'Lectures needed for basic knowledge', 'lectures can be boring, so good to get up & actually do something on simulated models'
	Comparison to problem-based learning (PBL)	'Used PBL at medical school', 'more useful than PBL as practically doing it rather than talking through scenarios'
	Comparisons to teaching within other specialties	'Would be useful for more general specialties such as surgery & medicine', 'haven't really used models for teaching in other specialties', 'prefer this method as can practise as many times', 'no other specialty has offered this'
Change in behaviour after teaching	Diagnosing	'More confident recognising presentations but not practically doing procedure', 'confidence definitely improved', 'can recognise things more easily', 'can confidently recognise an ENT problem'
	Performing procedures	'Still difficult as simulated models are not real people', 'still not confident with doing all procedures alone'
	Contribution to knowledge	'Still feel need to do background reading to feel fully confident'
Suggestions for improvement	Improving content	'This course is useful but more lectures to be added also so there is standard knowledge base established', 'simulation regarding how to deal with referrals would be useful'
	Improving access	'Make it a regional or national induction', 'make less expensive or free'
	Improving quality	'Can ask more senior people to teach', 'people with experience in teaching should teach this course'
	General feedback	'Very useful for those doing ENT & the on calls', 'would definitely suggest to others'
Contribution to career planning	Awareness of ENT as a career	'Know what ENT involves now', 'ENT is too niche', 'more aware of ENT as a career'
	Factors when choosing career	'Lifestyle & team', 'general knowledge & team', 'lifestyle & working with different ages', 'practical procedures & opportunity to do research', 'good work–life balance'
	No change in choosing ENT as a career	'Never considered ENT & hasn't changed', 'no change in terms of ENT as a career'

teaching. The simulation programme consisted of small workshops focusing on different practical skills using the induction model, with a short presentation before each workshop. With lecture-based teaching, there was no opportunity for delegates to practise ENT skills.

The trainees' views of simulation were generally positive; the majority agreed that as ENT is a 'practical specialty', having simulated models on which procedures could be practised was useful. The simulation course allowed for 'practising in a safe environment', which has been well documented previously. However, as some of the participants had no previous exposure to ENT or any aspect of ENT within their specialty, they found it was not useful, as there was 'no base knowledge' covered within the simulation course. This can be an area of improvement for future courses, and more lecture-based teaching focusing on basic ENT knowledge can be taught before practising on simulated models.

The findings suggest that although simulation is a very useful method of teaching, it should not be the sole method and used 'as a replacement for other on-the-job teaching'. It has been shown recently that junior doctors perform better in one-to-one viva assessments of ENT emergencies after a combination of both simulation and lecture-based teaching,[11] and our results also support this.

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Although the benefits of simulation, especially for teaching ENT, were recognised, some participants indicated that practising on the models felt 'fake' and 'not genuine'. Simulated models are known not to feel as realistic as when practising on a patient.[4] The next course could be improved by using only validated models, if resources and funding allow.

This is the first induction model in use that allows delegates to practise multiple ENT skills. The cost of the polystyrene head and the other materials needed is less than £10. Therefore, it is a model that is easily reproducible by different institutions. The plastic inserts used to create the external auditory canals, the nasal cavity and the larynx cost less than £5 each. For our programme, we used soap to represent debris within the external auditory canal, which required microsuction. In order to create the model, relevant areas were cut out of the polystyrene head. The heads were then attached to a foam mat, allowing them to be easily clipped or attached to hard surfaces such as tables. For the purposes of flexible nasendoscopy, different foreign bodies (such as a coin or peanut) were inserted over the plastic insert within the polystyrene head, and delegates had to describe what they saw when performing this skill.

There seemed to be minimal experience using simulated models as a method of teaching, with different methods of teaching being used in other specialties. Simulation was 'used in many different ways', including 'simulated ward rounds'; however, only one participant reported using a simulated model previously, when learning how to perform a medical chest drain. This may be because of the lack of resources available to specific specialties,[1] and the appropriateness of using models to teach certain aspects of a specialty. ENT is known to have many practical procedures; however, in specialties such as emergency medicine, it may be more relevant to have simulated emergency scenarios, rather than using simulated models for training. In addition, the use of models can incur a cost for trainees – 'simulation courses tend to be expensive', which is a recognised disadvantage of such courses. Furthermore, some participants suggested that simulation at their level of training was more useful for 'general medicine and general surgery', and felt that the course was 'too niche with regard to ENT'. Therefore, this course may be more useful when aimed at those who are covering ENT services.

In light of the minimal exposure to ENT within medical schools,[6] it is obvious why participants did not consider ENT as a career. The majority of participants felt they would consider ENT as a career now that they 'know what ENT involves'. Gelfand *et al.*[12] showed that the provision of dedicated teaching for a specialty increases the likelihood of students considering that specialty as a career.

Simulation-based teaching has led to improved patient outcomes in many clinical settings, including technical skills and crisis situations,[13] allowing time for reflection with the assurance of patient safety.[14]

Limitations

Candidates who were asked to complete the assessment after the lecture-based and simulation-based induction programmes were forewarned that they would be doing this. Therefore, although we tried to minimise the likelihood of answers being looked up, trainees may have revised prior to the assessment in order to gain higher marks. Hence, our assessment of knowledge retention may have reflected surface learning rather than strategic learning. In addition, the assessment may have been conducted too soon following the induction.

The chosen written assessment was used after simulation-based and lecture-based teaching. Although we tried to teach the same content throughout both induction programmes, using different methods of teaching, the written assessment could reflect more of a knowledge base of ENT rather than the practical aspects taught through simulation. Therefore, the findings could be biased for those candidates with prior ENT knowledge.

- Regular simulation induction programmes should be introduced
- Knowledge retention was increased for simulation-based teaching compared with lecture-based teaching
- Confidence levels were increased and anxiety levels were reduced with the simulation induction
- ENT induction programmes, with a focus on teaching practical skills, do not require vast resources or time

The simulation-based induction programme was half a day, whereas the lecture-based induction programme was 1–1.5 hours. Although the same content was covered in both programmes, the duration of the programmes may have affected the learners' experience and the assessment outcomes.

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Competing interests. None declared

References

1 Simpson C, Cottam H, Fitzgerald JE, Giddings CE. The European working time directive has a negative impact on surgical training in the UK. *Surgeon* 2011;**9**:56–7
2 Anwar M, Irfan S, Daly N, Amen F. EWTD has negative impact on training for surgeons. *BMJ* 2005;**331**:1476
3 Fitzgerald JE, Giddings CE, Khera G, Marron CD. Improving the future of surgical training and education: consensus recommendations from the Association of Surgeons in Training. *Int J Surg* 2012;**10**:389–92
4 Nguyen LH, Bank I, Fisher R, Mascarella M, Young M. Managing the airway catastrophe: longitudinal simulation-based curriculum to teach airway management. *J Otolaryngol Head Neck Surg* 2019;**48**:10
5 Rosenthal R, Gantert WA, Hamel C, Metzger J, Kocher T, Vogelbach P *et al.* The future of patient safety: surgical trainees accept virtual reality as a new training tool. *Patient Saf Surg* 2008;**2**:16
6 Steven RA, Mires GJ, Lloyd SK, McAleer S. An undergraduate otolaryngology curriculum comparison in the United Kingdom using a curriculum evaluation framework. *Clin Otolaryngol* 2017;**42**:963–8
7 Sharma A, Machen K, Clarke B, Howard D. Is undergraduate otorhinolaryngology teaching relevant to junior doctors working in accident and emergency departments? *J Laryngol Otol* 2006;**120**:949–51
8 Griffiths E. Incidence of ENT problems in general practice. *J R Soc Med* 1979;**72**:740–2
9 Ferguson GR, Bacila IA, Swamy M. Does current provision of undergraduate education prepare UK medical students in ENT? A systematic literature review. *BMJ Open* 2016;**6**:e010054
10 Biswas D, Rafferty A, Jassar P. Night emergency cover for ENT in England: a national survey. *J Laryngol Otol* 2009;**123**:899–902
11 Smith ME, Navaratnam A, Jablenska L, Dimitriadis PA, Sharma R. A randomized controlled trial of simulation-based training for ear, nose, and throat emergencies. *Laryngoscope* 2015;**125**:1816–21
12 Gelfand DV, Podnos YD, Wilson SE, Cooke J, Williams RA. Choosing general surgery: insights into career choices of current medical students. *Arch Surg* 2002;**137**:941–7

https://doi.org/10.1017/S0022215119002639 Published online by Cambridge University Press

13 McGaghie WC, Draycott TJ, Dunn WF, Lopez CM, Stefanidis D. Evaluating the impact of simulation on translational patient outcomes. *Simul Healthc* **2011**;6(suppl):S42–7
14 Javia L, Sardesai MG. Physical models and virtual reality simulators in otolaryngology. *Otolaryngol Clin North Am* 2017;**50**:875–91

Appendix 1. Planned questions for structured interviews

Questions may change prior to launch of interviews and can evolve following initial interview stages.

1. Why did you choose to take part in this course?
2. What stage of your training are you at?
3. What previous experience of ENT teaching have you had? Please inform us how many days/weeks, when during training and what type of teaching it was.
4. What are your views of simulation-based teaching?
   (a) What are the advantages?
   (b) What are the disadvantages?
5. What are your views of simulation-based teaching as part of ENT training? Has it enhanced your learning experience?
6. Do you have any other experience of simulation teaching in other specialties?
7. Has this course met your educational needs?
8. How do you feel about establishing a regular ENT simulation session as an induction programme for all junior doctors providing acute ENT services?
9. Has your confidence in managing acute ENT presentations changed since the course? Please explain.
10. Has this contributed to future career planning? Please explain.
11. What influences you to choose certain careers?
12. Are there any improvements that can be made?

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